

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

March 31, 2004

Mr Gary Schuetz
Rocky Flats Project Office
U S Department of Energy
10808 Hwy 93, Unit A
Golden, CO 80403

**SUBJECT: CONTRACT NO. DE-AC05-00OR22750
INDEPENDENT VERIFICATION TEAM PROJECT-SPECIFIC PLAN
FOR THE BUILDING 776/777 CLOSURE PROJECT, ROCKY FLATS
ENVIRONMENTAL TECHNOLOGY SITE CLOSURE PROJECT,
GOLDEN, COLORADO**

Dear Mr Schuetz

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) has enclosed the final project-specific plan for the Building 776/777 Closure Project. Please contact me at (865) 576-5321 or Tim Vitkus at (865) 576-5073 if we may provide additional information.

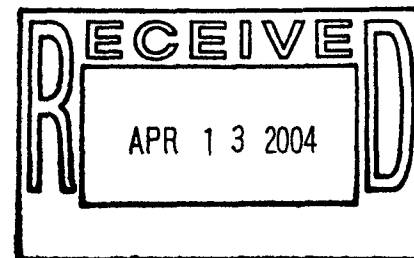
Sincerely,



Phyllis Weaver
Health Physics/Project Leader
Environmental Survey and
Site Assessment Program

PW dka

cc B Wallin, DOE/RFPO
E Abelquist, ORISE/ESSAP
T Vitkus, ORISE/ESSAP
File/0409



Distribution approval and concurrence:	Initials	Date
Technical Management Team Member	<i>TW</i>	<i>3/31/2004</i>

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**INDEPENDENT VERIFICATION TEAM
PROJECT-SPECIFIC PLAN
FOR THE BUILDING 776/777 CLOSURE PROJECT
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE CLOSURE PROJECT
GOLDEN, COLORADO**

INTRODUCTION AND PROJECT HISTORY

Building 776/777 was constructed in the mid-1950's. Building 776 served as the primary manufacturing facility for plutonium (Pu) weapons components and housed the Pu foundry and fabrication operations from 1958 until 1969. Building 777's main function was for parts assembly. Building 776/777 contained an extensive glove box (GB) network supporting various Pu operations. In 1969, the majority of the foundry and fabrication operations were transferred to Building 707 after a major fire resulted in gross radiological contamination of Building 776/777 and portions of Buildings 771 and 779. The operating areas of the first floor were highly contaminated and the entire second floor was moderately contaminated with airborne contamination that filtered through the floors and the walls. Office areas in Building 776/777 were moderately contaminated on the floors from water-borne materials. The roof was moderately contaminated in three areas, two were localized around vent penetrations and the third involved an area from around an exhaust duct to the edge of the roof. After the fire, the majority of the GBs were removed from Building 776 and the large room that contained these GBs was compartmentalized into several areas that were separated by physical barriers to confine radioactive material releases.

Upon completion of initial cleanup activities, limited production operations were resumed, however, the main focus of activity for the building was shifted to waste and residue handling, disassembly of retired weapons components and special projects. Operations in Building 777 included machining, product assembly and disassembly, testing and inspections of projects and support operations. These operations continued until production was curtailed in 1989 (KH 2003a).

Prepared by the Environmental Survey and Site Assessment Program, Radiological Safety, Assessments, and Training, Oak Ridge Institute for Science and Education, Oak Ridge, TN, under Contract No. DE-AC05-00OR22750 with the U.S. Department of Energy.

Kaiser-Hill Company, L L C (KH), is the Department of Energy (DOE) contractor responsible for closure of the Rocky Flats Environmental Technology Site Closure Project (RFEIS) by the year 2006. To meet the closure goal, KH plans to characterize, remediate, perform pre-demolition surveys (PDS) and then demolish each building at the site. However, Building 776/777 will not be decontaminated to meet guidelines for unconditional release.

KH will perform final characterization surveys to verify that remaining residual contamination is consistent with the objectives of the Decommissioning Operations Plan (DOP) and as low as reasonably achievable (ALARA) based decontamination efforts. The goal of the Building 776/777 demolition project is to maintain releases to the environment and doses to workers ALARA. The ALARA goals will be achieved by using a combination of decontamination techniques to include component removal, wiping, washing with various cleaning solutions, concrete shaving and scrubbing, etc. Remaining contamination will be controlled with fixatives, encapsulants and demolition techniques that will be designed to minimize releases of residual contamination. The objective of the characterization survey is to provide the data required for developing the source term input for waste stream profiling and for modeling potential airborne releases during demolition and the resultant dose to the co-located worker and the general public.

The DOE's Rocky Flats Project Office (RFPO) has requested that the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) provide independent verification (IV) of pre-demolition survey activities for the Building 776/777 Closure Project. This project-specific plan (PSP) has been prepared to address these IV activities for Building 776/777.

PROJECT DESCRIPTION

Building 776/777 is a two-story building with a partial basement and a common wall that separates Buildings 776 and 777. A tunnel that connects to Building 771 is located in the northeast corner of Building 776. The first floor of Building 776/777 has an area of 135,000 ft², the second floor, 88,000 ft², and the basement, 1,600 ft², for a building total of 224,600 ft². Building 776/777 has had several additions since it was originally built, to include the east side

of Building 777, a dock enclosure, a radiography area, an autoclave facility, a cleaning and plating facility, the Betatron vault and a two-story office addition (KH 2003a)

PROJECT ORGANIZATION AND RESPONSIBILITY

In support of the DOE independent verification of the Building 776/777 Closure Project, ORISE/ESSAP will work for the DOE/RFPO as the independent verification contractor (IVC). The CDPHE will also participate in the IV through the DOE and may request additional characterization measurements be made. All results will be provided to CDPHE as early as possible. Organizational responsibilities are detailed in the IV Program Plan (IVPP) (ORISE 2004a). The IVC will assemble an independent verification team (IVT) to perform work described in this survey plan. This plan will be performed under the direction of Eric Abelquist, Program Director, Tim Vitkus, Survey Projects and IVT Program Manager, and Phyllis Weaver, Project Leader with ESSAP. The cognizant project leader or site supervisor, after consultation with the DOE/RFPO Project Baseline Document Lead and the IVT Program Manager, has the authority to make appropriate changes to this Project-Specific Plan (PSP) as deemed necessary.

PROJECT HEALTH AND SAFETY

The IVT will adhere to all applicable regulatory requirements and participate in required site-specific training. The IVT activities will be performed under the site's overall health and safety plan (HASP) and radiological protection plan (RPP) for buildings and work areas during site activities. Personnel working on the project will be informed of known and potential hazards to effectively apply required safety precautions. The IVT will walkdown the project area prior to initiating surveys to evaluate potential health and safety issues. The walkdown will provide information to determine if the hazards present are currently addressed by ESSAP's Survey Procedures Manual job hazard analyses (JHAs). An appropriate JHA will be prepared prior to initiating surveys if a hazard is identified that is not covered in the ESSAP manual.

INDEPENDENT VERIFICATION OBJECTIVES

The objectives of this PSP will be to implement the DQO process, as defined in the IVPP, for evaluating pre-demolition characterization surveys for the Building 776/777 Closure Project against the defined building-specific residual contamination criteria. The IVT will serve to

assure that the source term data is adequate for demonstrating that the project's characterization survey objectives are met. Specifically, the IVT will verify the final characterization program being used by the D&D contractor complies with its Project Specific Pre-Demolition Survey Plans. Changes to this IV plan will be immediately communicated to the RFPO and documented in the ORISE site logbook.

IN-PROCESS INSPECTION

To expedite the D&D process, the IVC will coordinate and work with the project to conduct the in-process inspection, including Type B verification surveys, during the D&D contractor's PDS activities rather than after survey and reporting functions have been completed. Type B verification will be conducted as described in the IVPP and in-process inspections will follow the applicable lines of inquiry, as outlined in Appendix A of the IVPP, as appropriate. The in-process inspection evaluates the potential outcome of the survey based on the review of significant documentation and procedure implementation. This includes reviewing the methodology used to establish and implement the average surface contamination values (ASCVs), procedures for the selection, calibration, and use of survey instrumentation, and adequacy of survey and analytical planning and procedures. Type B verification will include implementing the field sampling and measurement plan described herein.

Scheduling by the D&D contractor for remedial activities at the Building 776/777 Closure Project will require the IVT to initially focus on Type B verifications in Building 776/777 which will be completed during on-site visits. The in-process inspection portion of the IVT verification will provide the additional evidence that the project has been designed adequately and that the data represent current radiological conditions. Historical information and available radiological data will be reviewed to ensure that the appropriate actions towards the completion of pre-demolition activities have been conducted.

DOCUMENT REVIEW

The IVT will review the D&D contractor's procedures, PDS plan, and PDS data and documentation. The focus of the review will include survey methodology and survey coverage (e.g., surface scans, surface activity measurements, media sampling, and analysis), and

instrumentation and calibration, to determine the adequacy and appropriateness of the D&D contractor's approach relative to the DQOs. These reviews include data interpretation, statistical evaluation, and comparison of results with the site-specific ASCVs to ensure that the appropriate methodologies are applied and performed correctly.

FIELD SAMPLING AND MEASUREMENT PLAN

RADIOLOGICAL SURVEY PROCEDURES

The following procedures will be used by the IVT to conduct verification survey activities on building surfaces. Survey activities will be performed in accordance with the ORISE/ESSAP Survey Procedures Manual and the Quality Assurance Manual (ORISE 2003 and 2004b). The IVT may select at random or on a judgmental basis, approximately 10 to 20 percent of the 41 survey units in the Building 776/777 Closure Project for Type B verification. Initially, the IVT may select a higher percentage of survey units and survey unit coverage, however, as verification activities progress, these percentages may be increased or decreased based on survey findings.

The IVT will also take input from the DOE on specific measurements requested by the DOE. The Colorado Department of Public Health and Environment may request the DOE to also input into these requests. The results of these measurements will be communicated to DOE as early as possible and the data will be evaluated in the same manner as other ORISE measurement data.

Reference Grid

The IVT will use the survey unit reference system established by the D&D contractor to identify measurement and sampling locations. Measurement and any sampling locations will also be documented on detailed survey maps and/or photographic records.

Surface Scans

Surface scans will be performed over both encapsulated surfaces and in areas prior to encapsulation in order to identify areas of elevated direct radiation that exceed the average levels. The intent is to ensure that locations containing residual activity that would affect the reported average levels used for waste streams characterization and air modeling have been identified and investigated by the contractor. Surface scans for gamma radiation may be

performed on up to 25 percent of the floors and up to five percent of the lower walls (up to 2 meters) and upper surfaces in each selected survey units. Additionally, alpha scans may be performed to evaluate areas with the highest gamma radiation levels. Scans for alpha and gamma radiation will concentrate on areas where the potential is greatest for plutonium contamination based upon historical information, D&D contractor findings, or the IVT survey findings. Particular attention will be given to cracks and joints in the floor and on walls, ledges, drains, and horizontal surfaces where material may have accumulated. General areas also will be selected to evaluate contractor-determined average activity concentrations.

Surface scans will be performed using instrumentation based on the best available technology and type of contamination. Standard survey instruments will include gas proportional detectors or phoswich detectors, consisting of zinc sulfide (ZnS) and plastic scintillators, and sodium iodide (NaI) FIDLER scintillation detectors. Detectors used for scanning will be coupled to ratemeter-scalers with audible indicators. Any locations of elevated direct radiation identified that are an order of magnitude or greater than that already identified by the contractor will be brought to the attention of DOE for further investigation.

Surface Activity Measurements

The IVT will initially collect 10 to 20 direct measurements at D&D contractor measurement locations for direct data comparison and to establish any instrument biases between the D&D contractor and the IVT. The intent of direct surface measurements is to provide evidence for validating the contractor's source term activity calculations. The instrumentation used for direct measurement comparison will be similar to that used by the contractor.

Direct measurements for gamma and/or alpha activity also will be performed at locations of elevated direct radiation identified by surface scans and at other suspect locations. Surface activity measurements will be performed using scintillation and/or gas proportional detectors coupled to ratemeter-scalers.

Miscellaneous Material Sampling

At locations where field instrumentation determines that the contamination is entrained within any overlying matrix such as paint or residue that attenuates the radiation levels, samples may be collected for analysis by gamma and/or alpha spectroscopy. This field activity would only be conducted in survey units that have not been encapsulated. The data developed would be used to validate the factors used to convert field measurement results to surface activity levels.

DATA INTERPRETATION AND ASSESSMENT

Radiological samples and data will be returned to the ORISE/ESSAP laboratory in Oak Ridge, Tennessee, for analysis and interpretation. Radiological sample analyses will be performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 2004c).

Direct measurement data will be converted into units of disintegrations per minute per one hundred square centimeters (dpm/100 cm²). Miscellaneous samples will be analyzed by gamma and/or alpha spectroscopy and reported in units of picocuries per gram (pCi/g) and then converted to dpm/100 cm² as appropriate.

Radiological data will be compared to the D&D contractor's results and the established building-specific residual contamination criteria for Building 776/777. Results of in-process inspection items will be evaluated in order to make a recommendation as to the adequacy of the contractor's survey procedures and results. Any discrepancies identified will be investigated to determine the cause and recommend a resolution. Any unresolved issues will be evaluated and dispositioned using the conflict resolution process outlined in the IVPP (ORISE 2004a). Verification results will be provided to DOE/RFPO in a draft report for review and comment.

RESIDUAL CONTAMINATION CRITERIA

Survey results will be compared to the project-specific average surface contamination value (ASCV) developed by KII and approved by the DOE. The contaminant of concern for the Building 776/777 Closure Project is 35 year old weapons grade plutonium consisting of primarily Pu-239, Pu-240, and Am-241. Am-241 will serve as the surrogate—at an Am-241 to plutonium ratio of 1:8:1—for the plutonium isotopes when determining total activity levels from gamma measurements.

The ASCV targets for weapons grade plutonium are (KH 2003b)

Table 1 Average Surface Contamination Value

Resultant Value	10 mrem @ the site boundary ⁽¹⁾	0.1 mrem @ the site boundary ⁽²⁾
ASCV ⁽³⁾	45,500 $\mu\text{Ci}/\text{m}^2$	455 $\mu\text{Ci}/\text{m}^2$
Surface Activity ⁽⁴⁾	1 E9 dpm/100 cm^2	1 E7 dpm/100 cm^2

⁽¹⁾ This value is converted from Colorado Radiation Control—Division of Laboratory and Radiation Services, RH 45.4. It states "To implement the ALARA requirements—a constraint on air emissions of radioactive material to the environment such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 0.1 mSv per year from these emissions."

⁽²⁾ This value is a project specific emissions objective as discussed in the Building 776/777 Decommissioning Operations Plan, Appendix I, Demolition Plan.

⁽³⁾ This value is the average contamination over the surfaces of Building 776/777 that if modeled, could result in exceeding the applicable dose to the public at the site boundary. The units of $\mu\text{Ci}/\text{m}^2$ are used for data input into the air quality model.

⁽⁴⁾ Value that equates to the ASCV as calculated by ORISE.

LIST OF CURRENT PROCEDURES BE USED IN THE SURVEY

Applicable procedures from the ORISE/FSSAP Survey Procedures Manual (ORISE 2003) include:

Section 4.0 Quality Assurance and Quality Control

- 4.1 General Information
- 4.2 Training and Certification
- 4.3 Records and Reports
- 4.4 Equipment and Instrumentation
- 4.5 Sample Handling

- 4 6 Job Hazard Analysis – Sample Screening
- Section 5 0 Instrument Calibration and Operational Check-Out
 - 5 1 General Information
 - 5 2 Electronic Calibration of Ratemeters
 - 5 3 Gamma Scintillation Detector Check-Out and Cross Calibration
 - 5 4 Alpha Scintillation Detector Calibration and Check-Out
 - 5 6 Proportional Detector Calibration and Check-Out
 - 5 7 Alpha/Beta Scintillation Detector and Check-out
 - 5 11 Floor Monitor Check-Out
 - 5 14 Field Measuring Tape Calibration
 - 5 16 Job Hazard Analysis
- Section 6 0 Site Preparation
 - 6 2 Reference Grid System
 - 6 3 Job Hazard Analysis
- Section 7 0 Scanning and Measurement Techniques
 - 7 1 Surface Scanning
 - 7 3 Alpha Radiation Measurement
 - 7 5 Gamma Radiation (Exposure Rate) Measurement
 - 7 6 Job Hazard Analysis
- Section 8 0 Sampling Procedures
 - 8 7 Determination of Removable Activity
 - 8 15 Sample Identification and Labeling
 - 8 16 Sample Chain-of-Custody
 - 8 17 Job Hazard Analysis
- Section 9 0 Integrated Survey Procedures
 - 9 1 Background Measurements and Sampling
 - 9 2 General Survey Approaches and Strategies
- Section 10 0 Safety and Contamination Control

Applicable procedures from the ORISE/ESSAP Quality Assurance Manual (ORISE 2003b) include

- Section 1 ESSAP Quality Assurance Responsibilities
- Section 3 Training
- Section 4 Instrument Quality Control
- Section 5 Sample Chain-of-Custody
- Section 6 Analytical Quality Control
- Section 7 Data Quality Control
- Section 8 Document Quality Control
- Section 11 Critical Record Handling & Storage

REFERENCES

Kaiser-Hill Company (K-H) Rocky Flats Environmental Technology Site Building 776/777 Closure Project Decommissioning Operations Plan Golden, Colorado, Revision 1, July 1, 2003a

Kaiser-Hill Company Rocky Flats Environmental Technology Site Radiological Pre-Demolition Survey Plan, Building 776/777 Golden, Colorado, August 8, 2003b

Oak Ridge Institute for Science and Education Survey Procedures Manual for the Environmental Survey and Site Assessment Program Oak Ridge, Tennessee, November 7, 2003

Oak Ridge Institute for Science and Education (ORISE) Revised Independent Verification Program Plan for the U S Department of Energy Rocky Flats Field Office Environmental Management Program, Denver, Colorado Oak Ridge, Tennessee, March 2004a

Oak Ridge Institute for Science and Education Quality Assurance Manual for the Environmental Survey and Site Assessment Program Oak Ridge, Tennessee, January 7, 2004b

Oak Ridge Institute for Science and Education Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program Oak Ridge, Tennessee; March 16, 2004c

U S Department of Energy (DOE) Radiation Protection of the Public and the Environment Washington, DC DOE Order 5400.5, February 1990

U S Department of Energy Application of Surface Contamination Guidelines for DOE Order 5400.5 Washington, DC, April 23, 1998

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March 12 2004

Mr Joseph Legare
U S Department of Energy
Rocky Flats Project Office
10808 Hwy 93, Unit A
Golden, CO 80403

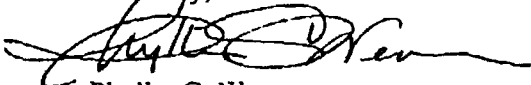
**SUBJECT DOE CONTRACT NO. DE-AC05-00OR22750
RESUBMITTAL OF THE INDEPENDENT VERIFICATION PROGRAM
PLAN FOR THE U.S. DEPARTMENT OF ENERGY ROCKY FLATS
PROJECT OPERATIONS—ROCKY FLATS ENVIRONMENTAL
TECHNOLOGY SITE CLOSURE PROJECT DENVER, CO**

Dear Mr Legare

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) is resubmitting for concurrence signature the enclosed final version of the Independent Verification Program Plan. The document was also updated to include minor editorial changes and current procedure manual references. Upon your approval, please provide a copy of the approved document to our office for our records.

If you have any questions please contact me at (865) 576-5321 or Tim Vitkus at (865) 576-5073

Sincerely,



Phyllis C Weaver
Project Leader/Health Physicist
Environmental Survey and
Site Assessment Program

PCW ar

Enclosure

cc G Schuetz, DOE/RFPO
 E Abelquist, ORISE/ESSAP
 T Vitkus, ORISE/ESSAP
 File/0957

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Independent Verification Program Plan
For the U S Department of Energy,
Rocky Flats Project Office
Environmental Management Program
Golden, Colorado

Prepared by
Oak Ridge Institute for Science and Education
Oak Ridge, Tennessee
under contract DE-AC05-00OR22750

March 2004

Prepared for the
U S Department of Energy
Rocky Flats Project Office

APPROVAL

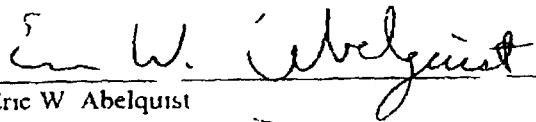
Independent Verification Program Plan
For the U S Department of Energy,
Rocky Flats Project Office
Environmental Management Program
Golden, Colorado

March 2004



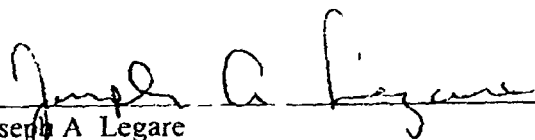
Timothy J. Woods
IVC Program Manager
Oak Ridge Institute for Science and Education

3/12/2004
Date



Eric W. Abelquist
Director
Radiological Safety, Assessments, and Training
Oak Ridge Institute for Science and Education

3/12/04
Date



Joseph A. Legare
Assistant Manager
for Environment and Stewardship
U S Department of Energy
Rocky Flats Project Office

3/12/04
Date

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ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
D&D	decontamination and decommissioning
DCGL	derived concentration guideline level
DOE	U S Department of Energy
DQO	data quality objectives
DPP	decommissioning program plan
EPA	U S Environmental Protection Agency
ESSAP	Environmental Survey and Site Assessment Program
GM	Geiger Mueller
H&S	health and safety
HASP	health and safety plan
IVC	independent verification contractor
IVPP	independent verification program plan
IVI	independent verification team
K-H	Kaiser-Hill Company, I L C
IRA	lead regulatory agency
MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
MDC	minimum detectable concentration
NaI	sodium iodide
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
PBD	project baseline document
PDS	pre-demolition survey
PDSP	pre-demolition survey plan
PDSR	pre-demolition survey report
PSP	project-specific plan
RFCA	Rocky Flats Cleanup Agreement
RFPO	Rocky Flats Project Office
RFETS	Rocky Flats Environmental Technology Site
RLCR	reconnaissance level characterization report
ROC	radionuclides of concern
QA	quality assurance
QC	quality control
ZnS	zinc sulfide

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INTRODUCTION

This document, *Independent Verification Program Plan for the U S Department of Energy, Rocky Flats Project Office Environmental Management Program*, serves as the primary implementing document to conduct consistent independent verification of pre-demolition survey actions by decontamination and decommissioning (D&D) contractors at the Rocky Flats Environmental Technology Site (RFETS) Closure Project. This document was prepared in accordance with U S Department of Energy (DOE) direction in support of efforts that ensure contractors comply with the facility release specifications and that all specified regulatory requirements and regulatory guidelines regarding these activities are met.

At the request of the DOE Rocky Flats Project Office (RFPO), the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) will serve as the independent verification contractor (IVC). Independent verification is the process by which DOE/RFPO will assess the adequacy and effectiveness of the pre-demolition survey (PDS) performed by the D&D contractor. Specifically, independent verification is a QA/QC function that provides oversight of the PDS to ensure the D&D contractor complies with the site pre-demolition characterization requirements. The IVC will use the independent verification program plan (IVPP) to implement consistent independent verification of PDSs at the RFETS. This IVPP defines the approach used by the IVC to achieve independent verification. The independent verification process enhances the credibility of the D&D process and ensures consistency among RFETS closure projects.

PURPOSE AND OBJECTIVES

The purpose of this IVPP is to provide general implementing guidelines for independent verification. The IVPP is used to develop project-specific plans (PSPs) to address each specific closure project. This IVPP defines the data quality objectives (DQOs), in-process inspection approach, and operating procedures necessary to ensure that closure objectives are met. Each PSP is considered a living document that will be updated as the D&D contractor scope, schedule,

and milestones change. The PSP facilitates an independent, yet parallel, verification process sufficiently integrated with project activities so as not to negatively impact the project. The verification activities that will be discussed in the PSPs are supported by ESSAP's controlled Survey Procedures, Quality Assurance, and Laboratory Procedures Manuals.

The objectives of the verification process are to perform an independent evaluation of the PDS processes and provide assurance to DOE/RFPO that the D&D contractor's PDS, sample analysis procedures, and the supporting documentation provide an accurate and complete description of the final radiological conditions and that release criteria are met.

SCOPE OF THE IVPP

The scope of the IVPP is limited to the radiological contaminants of concern present at the site. Independent verification of assigned projects may be implemented at two different levels, Type A and Type B depending on:

- complexity of the decommissioning project,
- radiological history of the facility,
- nature of the radiological contaminants and their form,
- results of previous verification activities, and
- extent of decontamination required to meet the release criteria.

The degree of verification activities and coverage is based on the potential level of risks and hazards to the public, liability to DOE, and findings during verification activities. The IVC will provide recommendations to DOE/RFPO on which type of verification should be implemented.

The simplest type of verification used by the IVC is called a Type A or limited verification. The Type A verification activities include document review, data validation, and possible confirmatory sample analyses. The Type B or full verification includes visual inspections and independent verification survey activities, in addition to processes involved in the Type A verification.

A Type A verification is generally performed when a historical assessment of process knowledge indicates a low potential for residual contamination. Type A verifications are completed most often for non-process areas, such as building office areas. A Type B verification is performed for areas that have a higher potential for residual contamination, i.e., processing or manufacturing areas. The level of verification will be documented in the PSP such that the DQOs can be met.

Buildings at the RFETS have been defined in the decommissioning program plan (DPP) and assigned a classification based on the level of contamination within the building. The building typing is determined by the reconnaissance level characterization report and is concurred with by the lead regulatory agency (LRA). Independent verification activities will be primarily focused on Type 2 and 3 facilities associated with a greater risk of contamination as described below (K-H 1999).

Type 1	Building free of contamination
Type 2	Buildings without significant contamination or hazards, but in need of decontamination
Type 3	Buildings with significant contamination and/or hazards

The scope of the IVC involvement does not include oversight of occupational safety, radiological protection, environmental effluent, or emission oversight activities.

SITE BACKGROUND

The Atomic Energy Commission, (AEC) predecessor agency to the U.S. DOE, selected the Rocky Flats site in 1951 for producing nuclear and non-nuclear weapons components for the Nation's nuclear weapons arsenal and in 1952 production began. By 1993, production of nuclear weapons components was discontinued and soon after the site was placed on the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

National Priorities List. The Rocky Flats Cleanup Agreement (RFCA) was approved and signed in 1996 by the DOE, the U S Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE). This agreement establishes the regulatory framework for environmental restoration and activities at RFETS.

Previous processes at the RFETS used a variety of radionuclides and hazardous materials in the production of nuclear weapons components including plutonium, uranium, and beryllium. Kaiser-Hill Company, L L C, (K-H) is the primary site management contractor responsible for the safe closure of RFETS by 2006. The RFETS closure project currently plans to demolish all the building structures. The DOE/RFPO has oversight responsibility of D&D at the surplus facilities to ensure risks and hazards are mitigated. K-H has prepared the pre-demolition survey plan (PDSP) that provides release criteria and direction on the performance of PDS. The CDPHE and the EPA Region 8 have approved the PDSP for implementation.

SITE DESCRIPTION

The RFETS is located approximately 16 miles northwest of Denver, Colorado on State Highway 93 and Cactus Road. RFETS occupies approximately 385 acres within the 6,000-acre DOE reservation site. There are approximately 700 buildings and structures on the site, most of which were associated with the production of nuclear weapons. The site has been divided into two major operable units, the Industrial Area and the Buffer Zone. All nuclear facilities at the site are within the boundaries of the Industrial Area.

RESPONSIBILITIES

ESSAP will assemble the personnel to serve as the independent verification team (IVT). The IVT will provide all labor, equipment, subcontracting, and materials to sufficiently perform independent verification activities. The IVT will work closely with the DOE/RFPO representatives in managing an independent verification program. The IVT will coordinate with DOE/RFPO and the D&D contractor, as appropriate, to facilitate independent verification.

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without adversely impacting project schedules and costs. To accomplish this objective, the D&D contractor, through DOE/RFPO, will be requested to define and provide projected schedules and time lines to the IVT for resource allotment.

IVC PROGRAM MANAGER

The IVC program manager has overall management responsibility for the IVC activities. The IVC program manager serves as the primary point of contact between DOE/RFPO, the D&D contractor, and the IVI staff. The program manager is responsible for planning and controlling site activities and notifying the DOF of deficiencies and deviations that occur during verification activities. Specific responsibilities include managing IVT staff, approving project plans and documentation, developing cost plans and milestone schedules, and responding to requests of the DOE/RFPO points of contact.

PROJECT LEADER

The project leader is responsible for the proper implementation and planning of radiological verification activities, developing strategies for meeting milestones, arranging for technical assistance, managing and maintaining project-related records, serving as the primary point of contact for IVT staff during field activities, and ensuring radiological verification activities are performed in accordance with written procedures. The project leader will provide project communications and manage all project-related records.

RFPO POINTS OF CONTACT

The DOE/RFPO Project Baseline Document (PBD) Leads will provide the primary interface between the IVC and the site contractor. All communications with the site D&D contractor should be coordinated through the PBD Leads. The PBD Leads will provide schedule information and will be the initial point of contact within DOE/RFPO for any discrepancies or issues that arise from the IV. The PBD Leads may also contact subject matter experts within

DOE/RFPO for assistance as needed. Any communication with the IVT that may result in contractor actions must be coordinated with the PBD Lead.

DATA QUALITY OBJECTIVES FOR VERIFICATION

The IVC will implement the DQO process to ensure that resources are utilized in the most efficient manner. The IVC will develop a flexible approach to verification, where survey frequency is contingent on both the building type designation and survey area classifications, i.e., MARSSIM defined Class 1, 2, or 3, as well as, findings as the survey progresses (NRC 2000). In essence, the level of survey rigor is increased based on the level of contamination present. The following DQO process will be used for developing the appropriate level of verification.

Step 1 State the Problem

- Assess and determine the adequacy of the D&D contractor's PDS design, implementation, and documentation for demonstrating compliance with the release criteria.

Step 2 Identify the Decisions

- Has the D&D contractor prepared adequate PDS survey packages in accordance with guidance documents?
- Were field and laboratory instrumentation used or planned to be used adequate/appropriate for scanning, surface activity measurements, and analysis for the radionuclides of concern (ROCs)?
- Did calibration account for the ROCs?
- Were the PDS data adequately documented and supportive of the D&D contractor's decision regarding the final radiological status?
- Are the D&D contractor's results representative of current radiological conditions?
- Should a Type A or Type B verification be conducted based on criteria that includes radiological history of the facility, level of decontamination required to meet release

criteria, and remaining residual levels of contamination and its comparison to the release criteria

Step 3 Identify Inputs to Decisions

- Review ROCs, area classification, survey unit size, estimated mean and standard deviation
- Review the methods used to address the impact of multiple ROCs in PDS planning
- Review instrument use procedures including
 - MDC calculations
 - actual vs required scan sensitivity
 - calibration, including accounting for multiple radionuclides and any environmental factors that may influence instrument performance
- Review analytical procedures for appropriateness for measuring the ROCs
- Cross-check PDS data packages against plan requirements
- Use verification/confirmatory survey and analytical results to assist with evaluating facility radiological status
- Complete Type A verification activities if survey unit/area satisfies decisions inputs
- Recommend Type B verification activities for areas with potential for contamination or where Type A activities identified inconsistencies

Step 4 Define the Study Boundaries

- Select PDS data packages for review
- Select appropriate planning documents (or sections thereof) for review
- When conducting Type B surveys, select survey units/areas for confirmation
 - Determine scan coverage based on classification
 - For structure surfaces, surface activity measurements should at a minimum be limited to anomalous or judgmental areas, and comparative measurement locations. The necessity for, and the specific numbers of, other random/systematic samples should be separately evaluated using steps in the DQO process

Step 5. Develop a Decision Rule

- Has compliance been adequately demonstrated?
- If project documentation is complete, accurate, and represents current radiological conditions relative to the release criteria, then recommend acceptance, if insufficient, then provide technical comments
- Calculate action levels to investigate anomalies identified during verification/confirmatory surveys
- Evaluate anomalies identified during verification surveys for compliance including
 - Is it acceptable relative to size and concentration?
 - Has the D&D contractor adequately addressed?
 - Is it within the bounds of survey unit classification?
- Determine level of agreement for confirmatory analyses or measurements with the site's reported results
- Determine if systematic and judgmental samples and measurements are less than the DCGI.

Step 6. Specify Decision Errors

- For comment resolution, determine the significance of each issue and implications of the comment relative to the survey planning, survey performance, data generated, and/or overall conclusions for the sites status
- For confirmatory survey results contrary to the site's reported results, what is the magnitude of the finding (number of anomalies identified, size of the anomalies, classification of the area where they were identified), and what is the proposed remedy?
- For multiple anomalies, determine the root cause and reevaluate DQOs
- Confirmatory analysis/measurements should agree within expected statistical deviation of the procedure if disagreement occurs, determine root cause and make appropriate recommendations to DOE/RFPO for resolution

Step 7 Optimize the Verification Survey Design

- Ensure involvement at an early stage of the project, preferably at the time the PDS packages are first being drafted
- For larger sites requiring more than one visit, implement the streamlined in-process approach outlined in Appendix A

INDEPENDENT VERIFICATION TASKS

The outputs of the verification DQO process are specific project tasks. The review of D&D contractor documentation is one of the most important tasks performed by the IVI. Therefore, the depth at which verification tasks are implemented is heavily weighted on the input decisions that lead to performing a Type A or Type B verification. The independent verification tasks described below can be expedited through the lines of inquiry of the in-process inspection presented in Appendix A.

DOCUMENT REVIEWS

Document reviews are performed to ensure that criteria for a site appropriately assess survey procedures, instrumentation, and established residual radioactivity cleanup requirements. Available historical site assessments and process knowledge is reviewed to ensure the D&D contractor has identified and addressed all potential contamination pathways. A review of survey data interpretation is conducted to ensure that data results of survey measurements and sampling are in compliance with release specifications. Release specifications are contained in RFCA decision documents and establish criteria for residual contamination that may remain on equipment or facilities at the conclusion of decommissioning.

Review of Survey Procedures

Included in the D&D contractor's material disposition and release survey procedures is information pertaining to background level determinations, area classifications, reference grid

size and placement, survey measurements (e.g., surface scans, surface activity measurements, and media sampling and analysis)

Specifically, the IVT review ensures, in part, that all potential radioactive contaminants of concern have been measured, that scanning and sampling techniques are capable of detecting locations of elevated activity, that inaccessible areas have been addressed, and that investigation levels were established

Review of Survey Instrumentation

The rationale behind instrumentation selection will be reviewed, specifically, to ensure instrumentation selection meet the following criteria

- Appropriate for the desired survey measurement,
- Based on an instrument calibration source representative of the contaminant(s) (e.g., similar source geometry and radiation energy), and
- Supported by instrument response checks performed at the specified frequency and in agreement with the established site acceptance criteria

The review assesses the calculated expression for instrument sensitivity, typically stated as the minimum detectable concentration (MDC), and the instrument sensitivity relative to the release criteria

Review of Survey and Analytical Results

The IVT's review of the D&D contractor's survey findings will ensure that survey data are consistent with the PDS DQOs. The typical IVT review may include data interpretation, statistical evaluation, and comparison of results with guideline values. Data interpretation application is reviewed to ensure that calculations used to convert survey data to units are consistent with guideline units and are appropriate and accurate, such as with area averaging,

when necessary. The statistical evaluation is reviewed to determine that the appropriate statistical method was applied to the survey results.

The IVT will determine if D&D contractor procedures address how results will be compared to the release criteria and if survey results are documented on standardized forms. The IVT will verify that the D&D contractor addresses how results will be managed and documented if an area exceeds the release criteria and validate that the D&D contractor results demonstrate compliance with the release criteria for each area/building. Miscellaneous items that may be reviewed include the following:

- Indication of measurement and sampling locations,
- Indication of remediated areas,
- Data provided for all areas addressed during the pre-demolition survey, and
- A statement that release criteria have been met.

The IVT will review the D&D contractors analytical data following the procedures in the ORISE/ESSAP Quality Assurance Manual (ORISE 2004a) to ensure the results of sample collection activities support survey objectives. Standard data validation activities may be increased based on project specific needs.

INDEPENDENT VERIFICATION SURVEY PROCEDURES

The IVC program includes collecting independent samples and measurements when performing Type B verification. Samples and measurements verify that D&D contractor data are representative of the final radiological status. Independent measurements may include judgmental samples and measurements of elevated areas to determine data accuracy and may include re-sampling to ensure IVT data correlate with D&D contractor data.

Independent verification survey activities for radioactive contaminants will be performed following the procedures in the ORISE/ESSAP Survey Procedures Manual (ORISE 2003).

Additional guidance for survey activities may be obtained from NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, (NRC 1998) and the MARSSIM (NRC 2000)

Verification scans, judgmental measurements, and random sampling will be performed at the frequencies specified in the PSPs. Specific survey coverage and frequency of measurements will be dependent upon numerous factors including building type, area classification, confidence level established with a given D&D contractor, and findings as the survey progresses. The IVT will document survey locations on detailed survey maps. Whenever possible, the IVT will use the grid coordinate system established by the D&D contractor to reference survey locations.

Survey Instrumentation

Radiological survey instrumentation used by the IVT will be based on the best available technology, type of contamination, and defined release limits. For example, large-area detectors with data logging capabilities may be used to survey floor and wall surfaces. Conventional survey instrumentation will include sodium iodide (NaI) scintillation detectors, gas flow proportional detectors, Geiger-Mueller (GM) detectors, and zinc sulfide (ZnS) detectors. The IVT will calibrate the instruments according to the ORISE/ESSAP Survey Procedures Manual and/or established protocols. Calibration sources will be traceable to the National Institute of Standards and Technology.

Measurement Methods

Survey methods can be classified into three survey categories commonly known as scanning, surface activity measurements, and sampling surveys. Measurement techniques will use appropriately sensitive instrumentation for field use. The types of measurements and the specific portable instrumentation, and methods used to perform the measurements, will be in accordance with the ORISE/ESSAP Survey Procedures Manual and presented in the PSPs.

Scanning

Any area selected for verification surveys by the IVT will be subject to a scanning coverage of up to 100 percent for direct alpha, beta, and/or gamma radiation. Dependent upon facility history and use, floors and lower walls generally have a greater likelihood of having been contaminated. Therefore, these types of surfaces will usually warrant a greater scanning coverage than upper walls and ceilings. Surface scan coverage ranges will be addressed in each PSP. Any locations of elevated radiation detected while scanning will be marked for further investigation that will include judgmental measurements. If residual contamination is detected, additional areas will be scanned as necessary to delineate contamination boundaries. Particular attention will be given to cracks and joints in the floor and walls, ledges, ducts, drains, and horizontal surfaces where material may have accumulated. Scans will be performed using gas proportional, GM, and ZnS and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators.

Surface Activity Measurements

Any area selected for verification surveys by the IVT will be subject to surface activity measurements for total alpha and/or total beta surface activity. The number and locations of surface activity measurements will be determined as the survey progresses. The primary focus for direct measurements will be on locations of elevated activity identified by scans, as well as, a number of the D&D contractor locations to permit direct data comparison. Measurements will be performed at locations of elevated direct alpha and/or beta radiation identified by surface scans to quantify total alpha and beta activity and delineate contamination boundaries. Additional measurements to determine the average residual surface activity in a 1 m² area will be performed as necessary. Surface activity measurements will be performed using gas proportional, GM, and ZnS detectors coupled to ratemeter-scalers.

Sampling and Analysis

Any areas selected for verification surveys by the IVT will be subject to smear, residue, and/or swab samples, with the methods chosen based on the accessibility of surfaces. Smear samples for the determination of removable activity may be collected at each surface activity measurement location. Residue and/or swab samples may also be collected at specific locations where the surface area is inaccessible for surface activity measurement or where surface coverings such as paint are suspected. Samples will be returned to the ORISE/ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses will be performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 2004b). Specific types of analyses and determinations will be detailed in PSPs.

Data Evaluation

If verification data from a particular area indicate the presence of residual radiological contamination that exceeds the unrestricted release criteria, the IVT will recommend the rejection of that area for release. The IVT may also recommend the rejection for unrestricted release of specific areas where the D&D contractor data deviate from the IVT data, such that differences can not be accounted for and additional investigation is required. This recommendation for rejection would follow an evaluation of the cause for data discrepancies. Based on these findings, the IVT may recommend increasing the survey coverage corresponding to a minimum of the next higher MARSSIM classification level for the specific area. These rejection recommendations will be presented to the contractor and the DOE representative. The conflict resolution process as outlined in this program plan will evaluate any area that is recommended for rejection. All recommendations for rejection and associated conflicts will be documented within the site logbook.

QUALITY ASSURANCE/QUALITY CONTROLS

All verification surveys and sample analyses performed by the IVT will be documented in accordance with the requirements in the ORISE/ESSAP Quality Assurance Manual (ORISE 2004a). Data generated by IVT survey activities will be recorded on survey record forms, reviewed and validated, and managed and stored with all other project critical records. Critical IVT records, as defined in the QA Manual, will be maintained a minimum of seven years past the final project report. Archived site records are also retained electronically.

IVT DOCUMENTS

The IVT will generate project-specific documents that will provide a record of the verification activities.

Project-Specific Plan

The PSP identifies specific detail for achieving the verification DQOs by including level of survey effort, survey procedures, sample and measurement frequencies, equipment calibration, and sampling and analytical methods. Deviations from the IVPP and ESSAP procedures will be discussed in the PSP. Each PSP will be submitted to the DOF/RFPO for review and approval.

Field Documentation

As part of the verification program, the IVT will generate standardized data forms to record verification data. In-process inspection investigations and results will be documented in a task specific logbook.

Verification Report

Verification survey reports will be prepared as part of the verification program for building release specifications. These reports will include survey procedures (by reference or summarized), types of analyses, verification results and recommendations for acceptance or rejection. The verification report shall include supporting documentation verifying the status of the building(s) and the site with final conditions and DOE-approved deviations noted.

Verification activities will include a complete building assessment to DOE-defined building release criteria. A draft report by the IVT will be completed within 21 days after completion of the D&D contractor's pre-demolition survey report (PDSR). Additionally, at the request of DOE/RFPO and when appropriate, the IVT will produce a short statement documenting when no significant deviations were noted during the course of the IV and that the facility meets the defined release criteria.

RESOLUTION OF DISCREPANCIES

A corrective action to resolve project discrepancies will be required if

- The IVT verification results do not agree with those of the D&D contractor within the expected result variability of the analytical methods used for measurements and/or samples, or
- If surface activity distribution results for a given population either indicate a disagreement in overall distribution or exceed any of the release criteria, or
- If approved D&D contractor procedures are identified as not being implemented properly

The IVT will notify DOE/RFPO of issues that arise during the performance of each project. Issues of significant findings or problems will be submitted in a document to the DOE/RFPO. DOE/RFPO will determine whether this documentation will be transmitted to the D&D contractor for resolution. All resolution of significant issues will be tracked and maintained.

Issue resolutions will be summarized and submitted to the DOE/RFPO by the D&D contractor and the IVT will review and concur with these resolutions, as appropriate. If the process cannot resolve an issue, the DOE/RFPO will be notified at the earliest opportunity. The IVC program manager will notify RFPO of any discrepancies that are outside the scope of the PSP. Depending on the potential degree of severity and project impact of the issue, the IVT will resolve each in the following three-tier fashion:

On-Floor Resolution

This consists of a discussion and decision by the IVT project leader or designee and the D&D contractor regarding the issue. No more than 1 hour will be used to resolve the issue. The identified conflict and the resultant discussion and resolution, including technical basis, will be documented in the site logbook with a corresponding E-mail to the IVC program manager.

Program Manager Resolution

If the issue requires more than 1 hour to resolve and/or the IVT project leader or designee requires additional support to resolve the issue, the program manager and verification lead, along with the D&D contractor, will attempt to resolve the issue within 1 working day and the RFPO will be notified of this level of issue. The issue identified and the resultant discussions and resolution, including technical basis, will be documented in the site logbook along with a corresponding E-mail to the PBD lead and the D&D contractor.

DOE-RFPO/Resolution

If the issue requires more than 1 day to resolve, and/or the program manager and D&D contractor require additional support to resolve the issue or the conflict necessitates a DOE decision, the DOE/RFPO representative will be requested to meet with the D&D contractor to resolve the issue. The identified issue, and the resulting discussion and resolution, will include a technical basis that will be documented in a formal letter from the IVC program manager to DOE/RFPO with a copy to the D&D contractor and IVT records.

HEALTH AND SAFETY

The IVT will adhere to all applicable regulatory requirements. The work associated with general technical support to the D&D programs will consist primarily of fieldwork. The IVT will work under the D&D contractors' and/or RFETS overall health and safety plan (HASP) for the buildings and work areas during site activities. Although the IVT will normally operate under the D&D contractor's site health and safety (H&S) program, additional medical monitoring and H&S and QA oversight may be needed for some project activities. On-site personnel will have at a minimum the following training: Hazardous Waste Operations and Emergency Response, RadWorker II, and procedure-specific training. Other training (e.g. elevated work, general employee training, etc.) may be required based on review by RFETS project personnel. Medical monitoring is not expected to be required for IVT field personnel.

Fieldwork requires the implementation of a program to limit chemical and radiation exposures to levels that are as low as reasonably achievable. Personnel working on the project will be informed of known and potential hazards to effectively apply required safety precautions. Because the IVT expects work will be performed under the D&D contractor and/or RFETS HASP, a separate HASP will not be prepared. The IVT PSPs will contain job safety analyses stating the expected hazards, mitigation measures, and required monitoring. Additionally, by its very nature, verification activities are expected to be conducted in areas that no longer require radiation work permits or special dosimetric considerations. Any exceptions to this will be addressed with the contractor prior to the start of verification activities.

REFERENCES

Kaiser-Hill Company (K-H) Rocky Flats Environmental Technology Site Decommissioning Program Plan, Revision 1 Golden Colorado, June 21, 1999

Oak Ridge Institute for Science and Education (ORIS-*) Independent Verification Program Plan for the U S Department of Energy, Oak Ridge Operations Environmental Management Program, Revision 1 Oak Ridge, TN, November, 1998

Oak Ridge Institute for Science and Education Survey Procedures Manual for the Environmental Survey and Site Assessment Program, Revision 13 Oak Ridge, TN, November 7, 2003

Oak Ridge Institute for Science and Education Quality Assurance Manual for the Environmental Survey and Site Assessment Program, Revision 14 Oak Ridge, TN, January 7, 2004a

Oak Ridge Institute for Science and Education Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program, Revision 23 Oak Ridge, TN, January 7, 2004b

U S Nuclear Regulatory Commission (NRC) Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, NUREG-1507, June 1998

U S Nuclear Regulatory Agency Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 1 August 2000

**APPENDIX A
IN-PROCESS INSPECTION
LINES OF INQUIRY**

APPENDIX A

IN-PROCESS INSPECTIONS

The IVF recommends in-process inspections to expedite the D&D process. The intent of this approach is to initiate the verification activities while the PDS is in progress, rather than after the D&D contractor has completed their surveys and reporting activities.

To the extent practicable, it is the intent that the Type B verification will be conducted as an in-process inspection during the course of D&D and pre-demolition survey activities. The general outline of the lines of inquiry that would normally be expected during in-process inspections are as follows:

Historical Site Assessment

- Review past records for spills or other releases of radioactive material and documentation of cleanup
- Review the D&D contractor's plans and schedule for completing decommissioning and surveying activities. Tour facilities and surrounding areas.

Identification of Contaminants and DCGLs

- Review previous measurement and analytical results for confirmation of site information and contaminants. In particular, data related to the D&D contractor's determination of radionuclide ratios, fractional contributions to total activity, and variability will be reviewed.

- Review the derived concentration guideline levels (DCGLs) used by the D&D contractor for structure surfaces and/or rubblized structures. Review the modeling codes and site specific parameters used in the DCGL development. Verify that the D&D contractor has accounted for all media in the pre-demolition surveys.
- Evaluate methodology for implementing DCGLs—e.g., use of surrogate measurements and modified DCGLs, gross activity DCGLs, DCGL_{LMCS}—to determine how samples/measurements will be compared, implementation of the unity rule, and/or how radionuclide variabilities—specifically modification of σ —will be integrated in DCGL implementation.

Building or Survey Unit Classification

- Evaluate the D&D contractor's technical basis for building or survey unit classification as impacted versus non-impacted.
- For impacted areas, review the available information and data used for initially classifying building types and survey unit classifications.

Pre-Demolition Survey Procedures and Instrumentation

Survey Instrumentation

- Review the calibration and performance check procedures to ensure calibrations will account for any environmental or other factors that could potentially impact performance. Evaluate the appropriateness of the calibration source energies in determining instrument efficiencies and any

applied weighting factors relative to the radionuclides of concern

Evaluate the D&D contractor's selection of surface efficiency value(s) and review the survey instrumentation operational checkout procedures and acceptance parameters

- Review both scanning and static measurement MDC determinations
- Review the procedures for field use of instrumentation and evaluate that any *a priori* factors that may impact use in the field have been accounted for, such as scan speed and background variability
- Review training records of personnel who will operate survey instrumentation

Pre-Demolition Survey Procedures

Review PDS procedures and planning documents for the following

- Verify the adequacy of reference areas selected by the D&D contractor for assessing background contributions to surface activity levels or volumetric media
- Review procedures for establishing survey unit boundaries. Review maps showing preliminary survey unit designations
- Review available radionuclide variability (σ) data that will be used for calculating required sample size. Additionally, determine whether the analytical methods and instrumentation used for the initial σ calculations are comparable to those in use during pre-demolition surveys

- Review procedures for required scan coverage based on survey unit classification
- Review methods for determining area factors used for evaluating areas of elevated activity detected during scans
- Review proposed investigation levels and adequacy relative to the required and actual scan MDC's
- Review proposed procedures and any associated factors for surveying embedded piping or other difficult to access or inaccessible areas
- Review sampling and chain-of-custody procedures

Analytical Procedures

- Review the capabilities of the laboratory instrumentation that will be used for sample analysis. Determine appropriateness and sensitivity of the selected equipment for the radionuclides of concern
- Review the D&D contractor's laboratory analytical procedures for radiological analyses. Specifically
 - Evaluate the laboratory's sample preparation techniques—geometries used for gamma spectrometry, etc
 - Review the Laboratory procedures for the interpretation of the gamma spectrometry results, particularly the radionuclide photopeaks used to identify various contaminants

- Review the laboratory QA/QC procedures, including requirements for duplicates, blanks, and matrix spikes. Determine the frequency of analysis for each of the QC checks. Determine whether the laboratory participates in an adequate cross-check or performance evaluation program, such as that offered by FPA.

QA/QC and Data Management

- Review the D&D contractor's QA/QC procedures as they relate to pre-demolition survey personnel training requirements and pre-demolition survey data acceptance criteria.
- Review the D&D contractor's data management system that will be used to track field and analytical results.